2ND Quarterly Report – Public Page

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Project Title: *Improving Magnetic Flux Leakage In-Line Inspection Corrosion Sizing Using Phased Array Guided Ultrasonic Waves*

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In-line inspection is an integral part of many pipeline company integrity management plans. The most common inspection technology for both natural gas and liquid pipelines is magnetic flux leakage (MFL). MFL was first used in the 1960's and was significantly improved in the 1980's and 1990's. While improvements are still being implemented, the performance capability of MFL tools has remained relatively unchanged for a decade. The major attribute of MFL is the ruggedness of the implementations that enable this technology to perform under the rigors presented by the pipeline environment. The most commonly reported deficiency of this technology is the lack of precision in reported sizes of the anomalies detected. The nominal depth sizing specification of most MFL in-line tools is a tolerance of +/-10% of wall thickness with a certainty of 80% (4 of 5 depth readings are within the tolerance).

The goal of this development is to improve corrosion anomaly depth sizing of MFL tools by adding phased array Guided-Wave Ultrasonic inspection technology (GWUT). The anticipated improved accuracy provided by this in-line inspection technology will help pipeline owners better assess corrosion anomalies and more accurately determine corrosion growth rates to enhance their integrity management programs.

The work completed this quarter was toward the development of a pattern recognition feature vector for the sizing estimation of different types of defect. A feature base pattern recognition classification methodology that uses data from the MFL and GWUT sensors was developed. Two-dimensional finite-element models were developed for defect types representative of axial grooves/slots, general corrosion, and circumferential grooves/slots. Many of the identified features will be directly applicable to the sizing of other defect geometries, such as pitting, with modification. At present, seven features and/or methods have been identified for the approximate sizing of the aforementioned defect types. Additional features and methods will be continually added throughout the tenure of the project so to create an extensive information-rich pattern recognition feature vector. Also presented was a technique for estimating the remaining wall thickness of a corrosion region with gradual wall loss.